IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	
CAIN ET AL.	Examiner: H. Nguyen
Serial No. **10/658,360**	Art Unit: 2662
Confirmation No. **2105**	
Filing Date: **SEPTEMBER 9, 2003**	
For: **MOBILE AD-HOC NETWORK (MANET) PROVIDING CONNECTIVITY ENHANCEMENT FEATURES AND RELATED METHODS**	

RESPONSE

MS Amendment
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Responsive to the Official Action of December 21, 2005, please enter the amendments and remarks set out below.

In the Claims:

1. (Previously presented) A mobile ad hoc network (MANET) comprising:

a plurality of mobile nodes each comprising a wireless communications device and a controller connected thereto;

said controller operating in accordance with a multi-layer protocol hierarchy for,

at an upper protocol layer, establishing a quality-of-service (QoS) threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer, cooperating with said wireless communications device to

determine the QoS metric for the at least one selected route,

transmit the given data to the at least one destination mobile node via the at least one selected route, and

adjust signal transmission power based upon a determination that the QoS metric has fallen below the QoS threshold.

2. (Original) The MANET of Claim 1 wherein, at the lower protocol layer, said controller also cooperates with said wireless communications device to adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold.

3. (Original) The MANET of Claim 1 wherein said wireless communications device provides an adjustable signal transmission pattern; and wherein, at the lower protocol layer, said controller also cooperates with said wireless communications device to adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

4. (Original) The MANET of Claim 1 wherein, at the at least one intermediate protocol layer, said controller encodes data prior to transmission; and wherein said controller also adjusts an amount of error correction coding based upon a determination that the QoS metric has fallen below the QoS threshold.

5. (Original) The MANET of Claim 1 wherein, at the

lower protocol layer, said controller cooperates with said wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

6. (Original) The MANET of Claim 1 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to transmit data at a data rate; and wherein said controller also cooperates with said wireless communications device to adjust the data rate based upon a determination that the QoS metric has fallen below the QoS threshold.

7. (Original) The MANET of Claim 1 wherein the upper protocol layer comprises an application layer.

8. (Original) The MANET of Claim 1 wherein the at least one intermediate protocol layer comprises at least one of a session layer, a transport layer, a network layer, and a radio transport layer.

9. (Original) The MANET of Claim 1 wherein the lower protocol layer comprises a physical layer.

10. (Original) The MANET of Claim 1 wherein the QoS threshold is based upon at least one of available bandwidth,

error rate, end-to-end delay, end-to-end delay variation, hop count, expected path durability, and priority.

11. (Previously presented) A mobile ad hoc network (MANET) comprising:

a plurality of mobile nodes each comprising a wireless communications device and a controller connected thereto;

said controller operating in accordance with a multi-layer protocol hierarchy for,

at an upper protocol layer, establishing a quality-of-service (QoS) threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer, cooperating with said wireless communications device to

determine the QoS metric for the at least one selected route,

transmit the given data to the at least one destination mobile node via the at least one selected route, and

adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold.

12. (Original) The MANET of Claim 11 wherein said wireless communications device provides an adjustable signal transmission pattern; and wherein, at the lower protocol layer, said controller also cooperates with said wireless communications device to adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

13. (Original) The MANET of Claim 11 wherein, at the at least one intermediate protocol layer, said controller encodes data prior to transmission; and wherein said controller also adjusts an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

14. (Original) The MANET of Claim 11 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

15. (Original) The MANET of Claim 11 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to transmit data at a data rate; and wherein said controller also cooperates with said wireless communications device to adjust the data rate based upon a determination that the QoS metric has fallen below the QoS threshold.

16. (Original) The MANET of Claim 11 wherein the upper protocol layer comprises an application layer.

17. (Original) The MANET of Claim 11 wherein the at least one intermediate protocol layer comprises at least one of a session layer, a transport layer, a network layer, and a radio transport layer.

18. (Original) The MANET of Claim 11 wherein the lower protocol layer comprises a physical layer.

19. (Original) The MANET of Claim 11 wherein the QoS threshold is based upon at least one of available bandwidth, error rate, end-to-end delay, end-to-end delay variation, hop count, expected path durability, and priority.

20. (Previously presented) A mobile ad hoc network (MANET) comprising:

a plurality of mobile nodes each comprising a wireless communications device and a controller connected thereto, said wireless communications device providing an adjustable signal transmission pattern, and said controller operating in accordance with a multi-layer protocol hierarchy for,

at an upper protocol layer, establishing a quality-of-service (QoS) threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer, cooperating with said wireless communications device to

determine the QoS metric for the at least one selected route,

transmit the given data to the at least one destination mobile node via the at least one selected route, and

adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

21. (Original) The MANET of Claim 20 wherein, at the at least one intermediate protocol layer, said controller encodes data prior to transmission; and wherein said controller also adjusts an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

22. (Original) The MANET of Claim 20 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

23. (Original) The MANET of Claim 20 wherein, at the lower protocol layer, said controller cooperates with said wireless communications device to transmit data at a data rate; and wherein said controller also cooperates with said wireless communications device to adjust the data rate based upon a determination that the QoS metric has fallen below the QoS threshold.

24. (Original) The MANET of Claim 20 wherein the upper protocol layer comprises an application layer.

25. (Original) The MANET of Claim 20 wherein the at least one intermediate protocol layer comprises at least one of a

session layer, a transport layer, a network layer, and a radio transport layer.

26. (Original) The MANET of Claim 20 wherein the lower protocol layer comprises a physical layer.

27. (Original) The MANET of Claim 20 wherein the QoS threshold is based upon at least one of available bandwidth, error rate, end-to-end delay, end-to-end delay variation, hop count, expected path durability, and priority.

28. (Previously presented) A method for operating a mobile node in a mobile ad hoc network (MANET), comprising a plurality of mobile nodes, in accordance with a multi-layer protocol hierarchy, the mobile node comprising a wireless communications device, the method comprising:

at an upper protocol layer, establishing a quality-of-service (QoS) threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer,

using the wireless communications device to determine the QoS metric for the at least one selected route,

causing the wireless communications device to adjust signal transmission power based upon a determination that the QoS metric has fallen below the QoS threshold, and

causing the wireless communications device to transmit the given data to the at least one destination mobile node via the at least one selected route.

29. (Original) The method of Claim 28 further comprising, at the lower protocol layer, causing the wireless communications device to also adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold.

30. (Original) The method of Claim 28 wherein the wireless communications device provides an adjustable signal transmission pattern; and further comprising, at the lower protocol layer, causing the wireless communications device to also adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

31. (Original) The method of Claim 28 further comprising, at the at least one intermediate protocol layer:

encoding data prior to transmission; and

adjusting an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

32. (Original) The method of Claim 28 further comprising, at the lower protocol layer, causing the wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

33. (Original) The method of Claim 28 wherein the wireless communications device transmits data at a data rate; and further comprising causing the wireless communications device to adjust the data rate at the lower protocol layer based upon a determination that the QoS metric has fallen below the QoS threshold.

34. (Previously presented) A method for operating a mobile node in a mobile ad hoc network (MANET), comprising a plurality of mobile nodes, in accordance with a multi-layer protocol hierarchy, the mobile node comprising a wireless communications device, the method comprising:

at an upper protocol layer, establishing a quality-of-service (QoS) threshold from among a plurality of different

possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer,

using the wireless communications device to determine the QoS metric for the at least one selected route,

causing the wireless communications device to adjust signal transmission gain in a desired direction based upon a determination that the QoS metric has fallen below the QoS threshold, and

causing the wireless communications device to transmit the given data to the at least one destination mobile node via the at least one selected route.

35. (Original) The method of Claim 34 wherein the wireless communications device provides an adjustable signal transmission pattern; and further comprising, at the lower protocol layer, causing the wireless communications device to also adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold.

36. (Original) The method of Claim 34 further comprising, at the at least one intermediate protocol layer:

encoding data prior to transmission; and

adjusting an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

37. (Original) The method of Claim 34 further comprising, at the lower protocol layer, causing the wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

38. (Original) The method of Claim 34 wherein the wireless communications device transmits data at a data rate; and further comprising causing the wireless communications device to adjust the data rate at the lower protocol layer based upon a determination that the QoS metric has fallen below the QoS threshold.

39. (Previously presented) A method for operating a mobile node in a mobile ad hoc network (MANET), comprising a plurality of mobile nodes, in accordance with a multi-layer protocol hierarchy, the mobile node comprising a wireless communications device providing an adjustable signal transmission

pattern, the method comprising:

at an upper protocol layer, establishing a quality-of-service (QoS) threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node for data transmission;

at at least one intermediate protocol layer below the upper protocol layer, selecting at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determining whether a QoS metric for the selected route falls below the QoS threshold; and

at a lower protocol layer below the at least one intermediate protocol layer,

using the wireless communications device to determine the QoS metric for the at least one selected route,

causing the wireless communications device to adjust the signal transmission pattern based upon a determination that the QoS metric has fallen below the QoS threshold, and

causing the wireless communications device to transmit the given data to the at least one destination mobile node via the at least one selected route.

40. (Original) The method of Claim 39 further comprising, at the at least one intermediate protocol layer:

encoding data prior to transmission; and

adjusting an amount of encoding based upon a determination that the QoS metric has fallen below the QoS threshold.

41. (Original) The method of Claim 39 further comprising, at the lower protocol layer, causing the wireless communications device to modulate the data using a first modulation technique if the QoS metric is greater than or equal to the QoS threshold, and otherwise using a second modulation technique.

42. (Original) The method of Claim 39 wherein the wireless communications device transmits data at a data rate; and further comprising causing the wireless communications device to adjust the data rate at the lower protocol layer based upon a determination that the QoS metric has fallen below the QoS threshold.

REMARKS

The Examiner is thanked for the thorough examination of the present application. In view of the arguments presented in detail below, it is submitted that all of the claims are patentable.

I. The Claimed Invention

The present invention is directed to a mobile ad hoc network (MANET). As recited in independent Claim 1, for example, the MANET includes a plurality of mobile nodes each including a wireless communications device and a controller connected thereto. The controller operates in accordance with a multi-layer protocol hierarchy. More particularly, at an upper protocol layer, the controller establishes a quality-of-service (QoS) threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node. At at least one intermediate protocol layer below the upper protocol layer, the controller selects at least one route for transmitting data to the at least one destination mobile node based upon the QoS threshold, and determines whether a QoS metric for the selected route falls below the QoS threshold. Furthermore, at a lower protocol layer below the at least one intermediate protocol layer, the controller cooperates with the wireless communications device to determine the QoS metric for the at least one selected route, transmit the given data to the at least one destination mobile node via the at least one selected route, and adjust signal

transmission power based upon a determination that the QoS metric has fallen below the QoS threshold.

Independent Claims 11 and 20 are directed to similar MANETs, and independent Claims 28, 34, and 39 are directed to related methods. Each of these claims also recites establishing a QoS threshold at an upper protocol layer, as in Claim 1.

II. The Claims Are Patentable

The Examiner rejected independent Claims 1, 11, 20, 28, 34 and 39 over U.S. Patent No. 6,629,151 to Bahl in view of U.S. Patent No. 6,832,249 to Ciscon et al. Bahl is directed to a wireless LAN system in which network layer interfaces perform static and dynamic queries, as well as requests to set attributes. While the Examiner correctly acknowledges that Bahl fails to teach or fairly suggest establishing a QoS threshold from among a plurality of different possible QoS thresholds based upon a type of given data to be transmitted to at least one destination node at an application layer, he contends that Ciscon et al. provides this noted deficiency. Ciscon et al. is directed to a method for providing broadband communications over a multi-protocol layer wired network (i.e., the Internet). As support for his contention, the Examiner points to col. 10 of this reference which discusses a network monitor that monitors communication resources of various network elements searching for QoS events.

It is respectfully submitted that the selective combination of references fails to teach or fairly suggest all of the recitations of the above-noted independent claims. As an

initial matter, while the above-noted text of Ciscon et al. discusses that different types of QoS metrics may be used, and that the way in which "error seconds" are determined may be changed based upon the given implementation, nowhere does this or any other passage in Ciscon et al. teach or fairly suggest establishing one of a plurality of QoS thresholds based upon a given type of data to be transmitted, as recited in the above-noted independent claims.

Moreover, neither of the cited references has anything to do with MANETs or performing routing in complex MANET environments. Bahl is directed to querying dynamic aspects of wireless connections in a wireless LAN. An existing wireless LAN typically includes a fixed network with one or more access points connected thereto, and wireless clients or devices access the fixed network via the access points over wireless links. A wireless LAN may have a basic peer-to-peer or "ad hoc" mode, as generally noted at col. 16, lines 6-22 of Bahl. In this mode, wireless devices within range of each other discover and communicate in peer-to-peer fashion without involving central access points. Ciscon et al. is concerned with wired network communications and control operations and is therefore even farther removed from the MANET environment.

In contrast, a MANET is a network that is formed of mobile (and potentially stationary) nodes, and is created on the fly as the nodes communicate with each other. The network does not depend on a particular node and dynamically adjusts as some nodes join or others leave the network. As discussed in the

background of the present application (see, e.g., paragraphs 0002-0005 of the originally filed specification), because MANETs lack a fixed infrastructure, nodes must self-organize and reconfigure as they move, join or leave the network. All nodes are essentially the same, and there is no natural hierarchy or central controller in the network. All functions may be distributed among the nodes. Nodes are often powered by batteries and have limited communication and computation capabilities. Also, the bandwidth of the system is usually limited. The distance between two nodes often exceeds the radio transmission range, and a transmission may have to be relayed by other nodes before reaching its destination. Consequently, a MANET network typically has a multi-hop topology, and this topology changes as the nodes move around.

Moreover, there is simply no proper motivation or suggestion to combine the references as the Examiner proposes. More particularly, Ciscon et al. addresses QoS issues in a wired network context, in that it proposes methods for monitoring QoS events to allow a response to be formulated (e.g., by provisioning additional circuits) that will improve or maintain a desired level of QoS. Bahl simply formulates mechanisms by which a software system can interface with a wireless device for the purpose of extracting status or to set parameters.

Further, while the Ciscon patent proposes some methods for controlling QoS in a wired system, these methods cannot be easily adapted to wireless systems. Achieving desired QoS in a wireless environment involves the use of domain-specific wireless

knowledge to control the allocation of resources to balance QoS and network capacity by controlling wireless-specific signal and radio coverage characteristics. Yet, neither Bahl nor Ciscon provides guidance or direction as to how this could be accomplished.

Moreover, QoS in a conventional wired network is primarily concerned with the avoidance and management of traffic congestion arising from the delay of packets due to buffering by routers and switches, and transmission delays over cable and wire links. QoS in a wireless network is more involved and requires accounting for bit errors due to low signal-to-noise ratio, and lost packets due to outages caused by attenuation, interference, blockages, etc., which are typically not encountered in the wired network context.

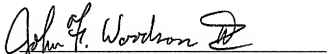
As such, since neither of the above-noted references teaches or fairly suggest applying the principles thereof to a MANET, or how to perform the claimed QoS operations in any wireless network, one of ordinary skill in the art would not have been motivated to combine the references as the Examiner proposes. Since the remaining prior art of record fails to provide the above-noted deficiencies, taking all of the teachings of the prior art as a whole, the prior art simply fails to teach or fairly suggest all of the recitations of independent Claims 1, 11, 20, 28, 34 and 39. Accordingly, it is submitted that these claims are patentable over the prior art. Their respective dependent claims, which recite yet further distinguishing features, are also patentable over the prior art and require no

further discussion herein.

CONCLUSIONS

In view of the foregoing, it is submitted that all of the claims are patentable. Accordingly, a Notice of Allowance is respectfully requested in due course. Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,



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